

Description of a new Species of freshwater Hardyhead *Craterocephalus kailolae* (Pisces: Atherinidae) from Safia, northeastern Papua New Guinea

W. IVANTSOFF, L. E. L. M. CROWLEY and G. R. ALLEN

(Communicated by P. SELKIRK)

IVANTSOFF, W., CROWLEY, L. E. L. M., & ALLEN, G. R. Description of a new species of freshwater hardyhead *Craterocephalus kailolae* (Pisces: Atherinidae) from Safia, northeastern Papua New Guinea. *Proc. Linn. Soc. N.S.W.* 109(4), (1986) 1987: 331-337.

Craterocephalus kailolae is described from specimens collected in Foasi Creek, Safia, northeastern Papua New Guinea. The new species is considered to be related to members of the *C. eyresii* species group. *C. kailolae* is the only freshwater hardyhead known from the northeastern drainages of Papua New Guinea as well as being the only representative of the *C. eyresii* group known from outside Australia. It can be distinguished from other species of *Craterocephalus* by a spatulate maxilla and other osteological characters and a combination of morphological features. The zoogeography of this group in relation to this distribution is discussed briefly. As no literature exists on the species composition of the genus *Craterocephalus*, its members and their authors are given.

Walter Ivantsoff and L. E. L. M. Crowley, School of Biological Sciences, Macquarie University, North Ryde, Australia 2113, and Gerald R. Allen, Department of Ichthyology, Western Australian Museum, Francis Street, Perth, Australia 6000; manuscript received 25 November 1986, accepted for publication 20 May 1987.

INTRODUCTION

The predominantly freshwater genus *Craterocephalus*, is endemic to Australia (Merrick and Schmida, 1984) and Papua New Guinea. In the most recent revision, (Ivantsoff, 1978) divided the genus into two species groups (see also Patten, 1978), '*C. eyresii*' and '*C. stercusmuscarum*'. Recent work by Crowley and Ivantsoff (unpublished) suggests that a third group, which includes the marine and estuarine species, can also be recognized. The '*C. eyresii*' group comprises *C. eyresii* (Steindachner, 1884), *C. cuneiceps* Whitley 1944, *C. marjoriae* Whitley 1948 as well as two species recently described by Ivantsoff *et al.* (1987). The '*C. stercusmuscarum*' group comprises *C. stercusmuscarum* (Günther, 1867) which includes spotted and unspotted subspecies (Ivantsoff *et al.*, 1987), *C. nouhuysi* (Weber, 1910), *C. randi* Nichols and Raven 1934, *C. lacustris* Trewavas 1940, *C. dalhousiensis* Ivantsoff and Glover (1974) and a new species from northern Australia (Ivantsoff *et al.*, 1987; Allen, 1982). The '*C. honoriae*' or the marine/estuarine group includes the remaining known species: *C. honoriae* (Ogilby, 1912), *C. pauciradiatus* (Günther, 1861) and *C. capreoli* Rendahl 1922 (now regarded as distinct, see Potter *et al.*, 1986).

Two related monotypic genera *Quirichthys* Whitley 1950 and *Allanetta* Whitley 1943 are under review and on present evidence (Crowley and Ivantsoff, unpublished) will probably be included in the synonymy of *Craterocephalus*.

The new species, *C. kailolae*, which is herein described, shows morphological, meristic and osteological characteristics which align it with the '*C. eyresii*' group. It is the only representative of that group to occur in Papua New Guinea.

MATERIALS AND METHODS

The specimens in this study were collected from a quiet backwater using a small seine

Description of a new Species of freshwater Hardyhead *Craterocephalus kailolae* (Pisces: Atherinidae) from Safia, northeastern Papua New Guinea

W. IVANTSOFF, L. E. L. M. CROWLEY and G. R. ALLEN

(Communicated by P. SELKIRK)

IVANTSOFF, W., CROWLEY, L. E. L. M., & ALLEN, G. R. Description of a new species of freshwater hardyhead *Craterocephalus kailolae* (Pisces: Atherinidae) from Safia, northeastern Papua New Guinea. *Proc. Linn. Soc. N.S.W.* 109(4), (1986) 1987: 331-337.

Craterocephalus kailolae is described from specimens collected in Foasi Creek, Safia, northeastern Papua New Guinea. The new species is considered to be related to members of the *C. eyresii* species group. *C. kailolae* is the only freshwater hardyhead known from the northeastern drainages of Papua New Guinea as well as being the only representative of the *C. eyresii* group known from outside Australia. It can be distinguished from other species of *Craterocephalus* by a spatulate maxilla and other osteological characters and a combination of morphological features. The zoogeography of this group in relation to this distribution is discussed briefly. As no literature exists on the species composition of the genus *Craterocephalus*, its members and their authors are given.

Walter Ivantsoff and L. E. L. M. Crowley, School of Biological Sciences, Macquarie University, North Ryde, Australia 2113, and Gerald R. Allen, Department of Ichthyology, Western Australian Museum, Francis Street, Perth, Australia 6000; manuscript received 25 November 1986, accepted for publication 20 May 1987.

INTRODUCTION

The predominantly freshwater genus *Craterocephalus*, is endemic to Australia (Merrick and Schmida, 1984) and Papua New Guinea. In the most recent revision, (Ivantsoff, 1978) divided the genus into two species groups (see also Patten, 1978), '*C. eyresii*' and '*C. stercusmuscarum*'. Recent work by Crowley and Ivantsoff (unpublished) suggests that a third group, which includes the marine and estuarine species, can also be recognized. The '*C. eyresii*' group comprises *C. eyresii* (Steindachner, 1884), *C. cuneiceps* Whitley 1944, *C. marjoriae* Whitley 1948 as well as two species recently described by Ivantsoff *et al.* (1987). The '*C. stercusmuscarum*' group comprises *C. stercusmuscarum* (Günther, 1867) which includes spotted and unspotted subspecies (Ivantsoff *et al.*, 1987), *C. nouhuysi* (Weber, 1910), *C. randi* Nichols and Raven 1934, *C. lacustris* Trewavas 1940, *C. dalhousiensis* Ivantsoff and Glover (1974) and a new species from northern Australia (Ivantsoff *et al.*, 1987; Allen, 1982). The '*C. honoriae*' or the marine/estuarine group includes the remaining known species: *C. honoriae* (Ogilby, 1912), *C. pauciradiatus* (Günther, 1861) and *C. capreoli* Rendahl 1922 (now regarded as distinct, see Potter *et al.*, 1986).

Two related monotypic genera *Quirichthys* Whitley 1950 and *Allanetta* Whitley 1943 are under review and on present evidence (Crowley and Ivantsoff, unpublished) will probably be included in the synonymy of *Craterocephalus*.

The new species, *C. kailolae*, which is herein described, shows morphological, meristic and osteological characteristics which align it with the '*C. eyresii*' group. It is the only representative of that group to occur in Papua New Guinea.

MATERIALS AND METHODS

The specimens in this study were collected from a quiet backwater using a small seine

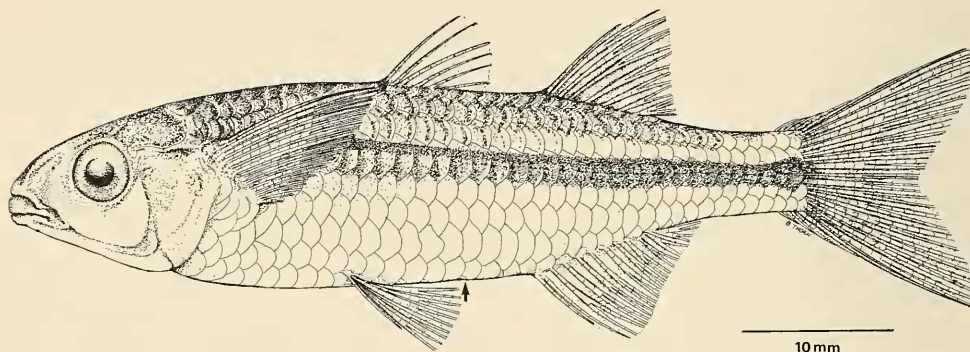


Fig. 1. Holotype *Craterocephalus kailolae*. AMS I.24640-001.

net of about 20mm mesh size which provided an adequate sample in a short time of collecting.

The methods of counting and measuring were modified from Munro (1967) and were as described by Prince *et al.*, (1982) and Patten and Ivantsoff (1983). In *Craterocephalus* species, the second dorsal and anal fins may or may not have an unbranched ray preceding branched rays. For the sake of uniformity, the first ray following the spine is not considered as part of the branched ray count throughout this work. The vertebral counts were obtained by radiography and the osteological studies were made on alizarin specimens prepared using standard techniques developed by Taylor (1967). Morphometric measurements and meristic counts were recorded for 31 specimens, designated holotype and paratypes (Table 1). These specimens are now deposited in The Australian Museum, Sydney, N.S.W. (AMS); Western Australian Museum, Perth, W.A. (WAM); Kanudi Fisheries Research Station, Kanudi, Papua New Guinea, (KFRS); Museum of Zoology, Ann Arbor, Michigan, U.S.A. (UMMZ).

DESCRIPTION

Craterocephalus kailolae sp. nov.

(Fig. 1)

Holotype — AMS 1.24640 - 001. 57.5mm standard length (SL) collected with a small seine; type locality, 3km west of Safia airstrip in still backwater of Foasi Creek, Papua New Guinea 9°36'S, 148°37'E, collected by Walter Ivantsoff and John Paska. September 16, 1985.

Paratypes, 30 (25.2-52.3), locality as for holotype, collected by G. R. Allen using small seine, September 8, 1982.

WAM P27783-001 (11 + 3 alizarin specimens); AMS I.24640-002 (10); KFRS F.5390.01 (3); UMMZ 213857 (3)

Overall size range 25.2-57.5mm SL. Measurements expressed as proportions and counts for the holotype and 30 paratypes are presented in Table 1.

DIAGNOSIS

Distinguished from all other species and subspecies of *Craterocephalus* by the combination of the following characters: small, moderately robust fish with seven rows of transverse scales with two rows above, one covering, and four below midlateral band. Midlateral scales 31-34, interdorsal scales 5-7. Mouth small, gape restricted by labial ligament. Gill rakers in first lower gill arch 8-10, those in angle of first arch (1-2) slightly elongated, others

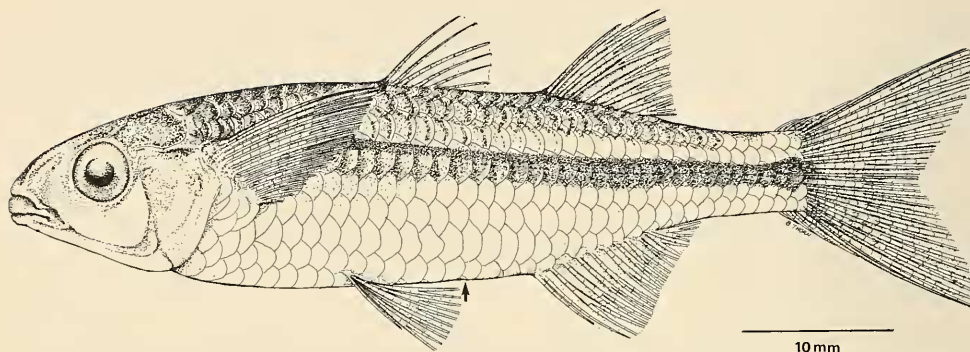


Fig. 1. Holotype *Craterocephalus kailolae*. AMS I.24640-001.

net of about 20mm mesh size which provided an adequate sample in a short time of collecting.

The methods of counting and measuring were modified from Munro (1967) and were as described by Prince *et al.*, (1982) and Patten and Ivantsoff (1983). In *Craterocephalus* species, the second dorsal and anal fins may or may not have an unbranched ray preceding branched rays. For the sake of uniformity, the first ray following the spine is not considered as part of the branched ray count throughout this work. The vertebral counts were obtained by radiography and the osteological studies were made on alizarin specimens prepared using standard techniques developed by Taylor (1967). Morphometric measurements and meristic counts were recorded for 31 specimens, designated holotype and paratypes (Table 1). These specimens are now deposited in The Australian Museum, Sydney, N.S.W. (AMS); Western Australian Museum, Perth, W.A. (WAM); Kanudi Fisheries Research Station, Kanudi, Papua New Guinea, (KFRS); Museum of Zoology, Ann Arbor, Michigan, U.S.A. (UMMZ).

DESCRIPTION

Craterocephalus kailolae sp. nov.

(Fig. 1)

Holotype — AMS 1.24640 - 001. 57.5mm standard length (SL) collected with a small seine; type locality, 3km west of Safia airstrip in still backwater of Foasi Creek, Papua New Guinea 9°36'S, 148°37'E, collected by Walter Ivantsoff and John Paska. September 16, 1985.

Paratypes, 30 (25.2-52.3), locality as for holotype, collected by G. R. Allen using small seine, September 8, 1982.

WAM P27783-001 (11 + 3 alizarin specimens); AMS I.24640-002 (10); KFRS F.5390.01 (3); UMMZ 213857 (3)

Overall size range 25.2-57.5mm SL. Measurements expressed as proportions and counts for the holotype and 30 paratypes are presented in Table 1.

DIAGNOSIS

Distinguished from all other species and subspecies of *Craterocephalus* by the combination of the following characters: small, moderately robust fish with seven rows of transverse scales with two rows above, one covering, and four below midlateral band. Midlateral scales 31-34, interdorsal scales 5-7. Mouth small, gape restricted by labial ligament. Gill rakers in first lower gill arch 8-10, those in angle of first arch (1-2) slightly elongated, others

TABLE 1

Measurements (expressed as proportions) and counts of the holotype and 30 paratypes of Craterocephalus kailoi from Safia, Papua New Guinea

	Holotype		30 Paratypes	SD
SL	57.5mm		25.2-52.3mm	
In SL				
		mean	range	
Head	3.8	3.6	(3.3-4.0)	.15
PecL	5.0	4.9	(4.6-6.0)	.35
H max	4.3	4.0	(3.6-4.5)	.21
H min	9.8	9.5	(8.8-10.2)	.31
Sn-OD1	2.0	2.0	(1.9-2.1)	.06
Sn-OD2	1.4	1.4	(1.3-1.5)	.04
Sn-OV	2.3	2.2	(2.1-2.3)	.08
Sn-TV	1.8	1.7	(1.6-1.8)	.05
SN-OA	1.5	1.5	(1.4-1.5)	.05
Sn-TA	1.3	1.3	(1.2-1.3)	.05
In Head				
Eye	3.4	3.3	(3.0-3.8)	.18
Interorbital	2.5	2.6	(2.4-2.8)	.12
Postorbital	2.3	2.3	(1.9-2.5)	.12
In Eye				
Snout	1.0	1.1	(0.9-1.5)	.13
Premaxilla	1.0	1.0	(0.9-1.2)	.07
Dorsal process of premaxilla	1.1	1.2	(1.0-1.5)	.12
Scale counts				
Midlateral	34	33.2	(31-34)	.82
Transverse	7	7.0	—	—
Predorsal	12	12.5	(11-14)	.90
Interdorsal	6	6.0	(5-7)	.26
Fin elements				
First dorsal spines	6	5.6	(4-7)	.63
Second dorsal branched rays	6	6.2	(5-7)	.48
Anal branched rays	8	8.2	(7-9)	.56
Pectoral branched rays	11	12.0	(11-13)	.68
Position of fins				
OD1 to TV	F4.0	F3.3	(F2.5-4.5)	.50
OD1 to TPec	B1.5	B1.4	(0-B2.5)	.57
OV to TPec	F1.0	F1.7	(0-F3)	.68
Other values				
Gill rakes in first lower gill arch	8	8.8	(8-10)	.55
Position of anus to TV	B1.0	B1.0	(0-B3)	.78
Vertebrae	34	34.3*	(33-35)	.69

* 17 specimens.

Abbreviations used in table: SL, standard length; Pec L, length of longest pectoral ray; H max, greatest body depth; H min, least body depth at caudal peduncle; Sn, snout; OD1, origin of first dorsal fin; OD2, origin of second dorsal fin; OV, origin of ventral fins; TPec, tips of pectoral fins; TV, tips of ventral fins; OA, origin of anal fin; TA, point of last ray insertion of anal fin. Position of fins and anus is expressed as a number of scales in front (F) or behind (B) point of reference. SD, standard deviation.

short, rounded and with spinules. Dorsal process of premaxilla long, extending into interorbital space. Anterior process of maxilla broad, spatulate, almost meeting its opposite at midline (Fig. 2). Palatine cylindrical, without pointed dorsal end. Branchiostegals 5.

TABLE 1

Measurements (expressed as proportions) and counts of the holotype and 30 paratypes of Craterocephalus kailoi from Safia, Papua New Guinea

	Holotype		30 Paratypes	SD
SL	57.5mm		25.2-52.3mm	
In SL				
		mean	range	
Head	3.8	3.6	(3.3-4.0)	.15
PecL	5.0	4.9	(4.6-6.0)	.35
H max	4.3	4.0	(3.6-4.5)	.21
H min	9.8	9.5	(8.8-10.2)	.31
Sn-OD1	2.0	2.0	(1.9-2.1)	.06
Sn-OD2	1.4	1.4	(1.3-1.5)	.04
Sn-OV	2.3	2.2	(2.1-2.3)	.08
Sn-TV	1.8	1.7	(1.6-1.8)	.05
SN-OA	1.5	1.5	(1.4-1.5)	.05
Sn-TA	1.3	1.3	(1.2-1.3)	.05
In Head				
Eye	3.4	3.3	(3.0-3.8)	.18
Interorbital	2.5	2.6	(2.4-2.8)	.12
Postorbital	2.3	2.3	(1.9-2.5)	.12
In Eye				
Snout	1.0	1.1	(0.9-1.5)	.13
Premaxilla	1.0	1.0	(0.9-1.2)	.07
Dorsal process of premaxilla	1.1	1.2	(1.0-1.5)	.12
Scale counts				
Midlateral	34	33.2	(31-34)	.82
Transverse	7	7.0	—	—
Predorsal	12	12.5	(11-14)	.90
Interdorsal	6	6.0	(5-7)	.26
Fin elements				
First dorsal spines	6	5.6	(4-7)	.63
Second dorsal branched rays	6	6.2	(5-7)	.48
Anal branched rays	8	8.2	(7-9)	.56
Pectoral branched rays	11	12.0	(11-13)	.68
Position of fins				
OD1 to TV	F4.0	F3.3	(F2.5-4.5)	.50
OD1 to TPec	B1.5	B1.4	(0-B2.5)	.57
OV to TPec	F1.0	F1.7	(0-F3)	.68
Other values				
Gill rakes in first lower gill arch	8	8.8	(8-10)	.55
Position of anus to TV	B1.0	B1.0	(0-B3)	.78
Vertebrae	34	34.3*	(33-35)	.69

* 17 specimens.

Abbreviations used in table: SL, standard length; Pec L, length of longest pectoral ray; H max, greatest body depth; H min, least body depth at caudal peduncle; Sn, snout; OD1, origin of first dorsal fin; OD2, origin of second dorsal fin; OV, origin of ventral fins; TPec, tips of pectoral fins; TV, tips of ventral fins; OA, origin of anal fin; TA, point of last ray insertion of anal fin. Position of fins and anus is expressed as a number of scales in front (F) or behind (B) point of reference. SD, standard deviation.

short, rounded and with spinules. Dorsal process of premaxilla long, extending into interorbital space. Anterior process of maxilla broad, spatulate, almost meeting its opposite at midline (Fig. 2). Palatine cylindrical, without pointed dorsal end. Branchiostegals 5.

Canals tubular and closed on nasals, anterior infraorbitals and posttemporals; those on frontals and temporals partially closed.

DESCRIPTION

Meristic counts and morphometric proportions for the holotype and paratypes are presented in Table 1.

Small, moderately robust fish, largest specimen known 57.5mm SL. Dorsal profile somewhat rounded, continuing in unbroken curve from origin of first dorsal to snout. Lips thick, mouthparts protrusible. Premaxilla almost never reaching vertical through anterior margin of orbit. Dorsal process of premaxilla long, reaching into interorbital space. Upper jaw with two rows of teeth pointing posteriorly. Ramus of dentary highly elevated posteriorly. Anteriorly, dentary expanded, forming wide edentulous plate. Other elements of mouth edentulous also. Pharyngeal teeth sharp and fine, never molariform. Body scales moderately large, scalloped and prominent, dorsoventrally elongated with circuli complete. Single large interorbital scale with one smaller scale on either side always present. Preopercle scaled.

Intercalars large. Anterior infraorbitals reduced, sometimes fused (Figs 3, 4). Large dorsal and ventral postcleithra present. Urohyal with well developed dorsal plate, reduced ventral plates, ventral pocket absent. Basihyal bone and cartilage about equal. Other osteological features similar to other members of the '*C. eyresii*' group as described later.

COLOUR

Preserved specimens yellow brown above silvery midlateral band and pale yellow below. Scales on dorsal surface and sides outlined with melanophores. Scales in row immediately above midlateral band pigmented only to end of first dorsal fin along side of body. Body below midlateral band unpigmented. Spine and rays of first and second dorsal and caudal fins with rows of melanophores, other fins unpigmented. Dorsum of head, snout and lips peppered with melanophores. Posterior border of orbit outlined with melanophores. Live specimens yellow brown with silvery band, not distinctly different from those preserved.

ETYMOLOGY

kailolae. Named after Mrs Patricia Kailola, a major contributor to the knowledge of ichthyology of Papua New Guinea. Without her help much of the work on Papua New Guinea species of *Craterocephalus* would have been very difficult.

RELATIONSHIPS WITH OTHER SPECIES OF *CRATEROCEPHALUS*

Craterocephalus kailolae is a member of the '*C. eyresii*' group (Ivantsoff, 1978; Patten, 1978). The group can be identified by the following characters: gut elongate, longer than body length; small finger-like epiotic crest; unbranched posterior myodome extending into basioccipital but without posterior opening; urohyal with ventral plates reduced; lower pharyngeals close but not fused and with sharp non-molariform teeth; mesopterygoid small; posterior edge of coracoid rounded, medial shelf reduced; scapular foramen large; interdorsal pterygiophores usually weakly developed or absent; anal plate small with no anterior elongation. Colour of midlateral band usually silvery in contrast to members of *stercusmuscarum* group where band darkly pigmented.

DISTRIBUTION AND ZOOGEOGRAPHY

Craterocephalus kailolae is at present known only from the type locality in the north-eastern highlands of Papua New Guinea. It appears to be present in relatively large

Canals tubular and closed on nasals, anterior infraorbitals and posttemporals; those on frontals and temporals partially closed.

DESCRIPTION

Meristic counts and morphometric proportions for the holotype and paratypes are presented in Table 1.

Small, moderately robust fish, largest specimen known 57.5mm SL. Dorsal profile somewhat rounded, continuing in unbroken curve from origin of first dorsal to snout. Lips thick, mouthparts protrusible. Premaxilla almost never reaching vertical through anterior margin of orbit. Dorsal process of premaxilla long, reaching into interorbital space. Upper jaw with two rows of teeth pointing posteriorly. Ramus of dentary highly elevated posteriorly. Anteriorly, dentary expanded, forming wide edentulous plate. Other elements of mouth edentulous also. Pharyngeal teeth sharp and fine, never molariform. Body scales moderately large, scalloped and prominent, dorsoventrally elongated with circuli complete. Single large interorbital scale with one smaller scale on either side always present. Preopercle scaled.

Intercalars large. Anterior infraorbitals reduced, sometimes fused (Figs 3, 4). Large dorsal and ventral postcleithra present. Urohyal with well developed dorsal plate, reduced ventral plates, ventral pocket absent. Basihyal bone and cartilage about equal. Other osteological features similar to other members of the '*C. eyresii*' group as described later.

COLOUR

Preserved specimens yellow brown above silvery midlateral band and pale yellow below. Scales on dorsal surface and sides outlined with melanophores. Scales in row immediately above midlateral band pigmented only to end of first dorsal fin along side of body. Body below midlateral band unpigmented. Spine and rays of first and second dorsal and caudal fins with rows of melanophores, other fins unpigmented. Dorsum of head, snout and lips peppered with melanophores. Posterior border of orbit outlined with melanophores. Live specimens yellow brown with silvery band, not distinctly different from those preserved.

ETYMOLOGY

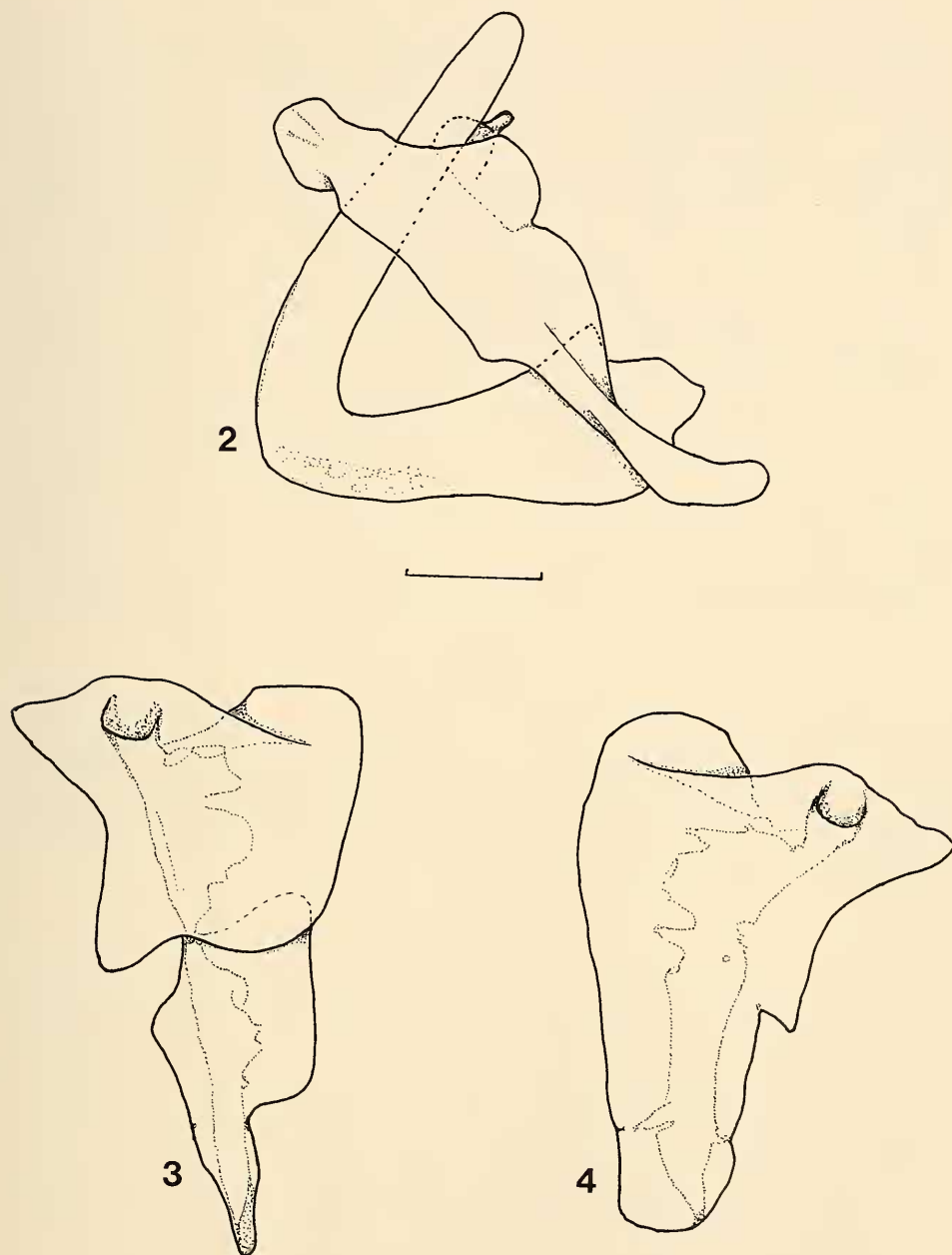
kailolae. Named after Mrs Patricia Kailola, a major contributor to the knowledge of ichthyology of Papua New Guinea. Without her help much of the work on Papua New Guinea species of *Craterocephalus* would have been very difficult.

RELATIONSHIPS WITH OTHER SPECIES OF *CRATEROCEPHALUS*

Craterocephalus kailolae is a member of the '*C. eyresii*' group (Ivantsoff, 1978; Patten, 1978). The group can be identified by the following characters: gut elongate, longer than body length; small finger-like epiotic crest; unbranched posterior myodome extending into basioccipital but without posterior opening; urohyal with ventral plates reduced; lower pharyngeals close but not fused and with sharp non-molariform teeth; mesopterygoid small; posterior edge of coracoid rounded, medial shelf reduced; scapular foramen large; interdorsal pterygiophores usually weakly developed or absent; anal plate small with no anterior elongation. Colour of midlateral band usually silvery in contrast to members of *stercusmuscarum* group where band darkly pigmented.

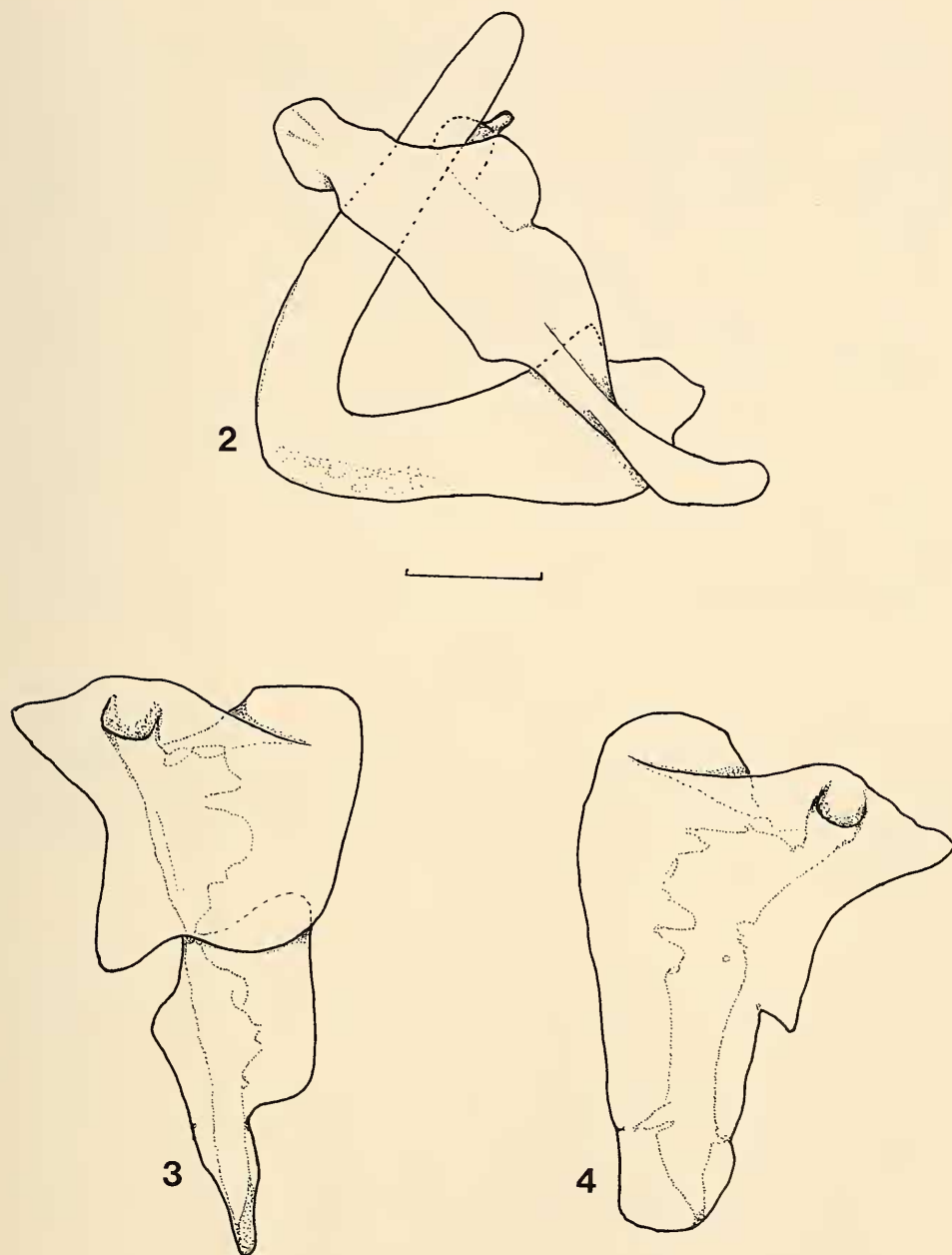
DISTRIBUTION AND ZOOGEOGRAPHY

Craterocephalus kailolae is at present known only from the type locality in the north-eastern highlands of Papua New Guinea. It appears to be present in relatively large



Figs 2-4. *Craterocephalus kailolae* — Paratype WAM P27783-001. 2) upper jaw elements; 3) first and second infra-orbitals — right side; 4) first and second infra-orbitals fused — left side. Scale line represents 1.00mm.

numbers in slower flowing branches of the main stream, in very shallow water, often only several centimetres deep. It also occurs in backwaters which may be shallow or deep, murky or clear.



Figs 2-4. *Craterocephalus kailolae* — Paratype WAM P27783-001. 2) upper jaw elements; 3) first and second infra-orbitals — right side; 4) first and second infra-orbitals fused — left side. Scale line represents 1.00mm.

numbers in slower flowing branches of the main stream, in very shallow water, often only several centimetres deep. It also occurs in backwaters which may be shallow or deep, murky or clear.

The location of this species is of great interest since all other hardyhead species from Papua New Guinea occur in southern drainages. These are *C. randi*, extending from the Fly River to the Port Moresby area, *C. lacustris*, at present known only from Lake Kutubu, but possibly also occurring in the Kiori and Wago Rivers draining the lake to the south, and *C. nouhuysi*, occurring in the Lorenz River, Irian Jaya, near the border of Papua New Guinea and possibly in the upper tributaries of the Fly River near Tabubil. These species are all members of the '*C. stercusmuscarum*' group. Their closely related counterparts, *C. stercusmuscarum stercusmuscarum* and *C. species B* (Allen, 1982) occur on the other side of the Arafura Sea and Torres Strait. *C. marjoriae*, *C. marianae* Ivantsoff *et al.*, 1987 and *C. species A* (Allen, 1982) also occur in the northern coastal areas of Australia but there are no known south coast representatives of the '*eyresii*' group in Papua New Guinea.

It appears that speciation of the genus *Craterocephalus* may have been slow, unlike the Melanotaeniidae, another speciose group of freshwater fishes common to both Papua New Guinea and Australia (Allen and Cross, 1982). *C. kailolae* must have been separated from its north Australian relatives 2-5 million years ago, that is, since the uplifting of the highlands in Papua New Guinea during Plio/Pleistocene (Veevers, 1984). The members of the '*C. stercusmuscarum*' group, on the other hand, could still have been sympatric 7-10,000 years ago, prior to the last transgression on Torres Strait, thus allowing for gene flow to continue and maintain similarity. *C. randi* and *C. s. stercusmuscarum* for example are morphologically and osteologically very close. The fact that *C. kailolae* is readily identifiable as a member of the '*C. eyresii*' group (although morphologically distinct from other members) supports the proposal that members of the genus *Craterocephalus* do not speciate rapidly.

ACKNOWLEDGEMENTS

We thank John Paska of Port Moresby who helped us to collect the fish, and Mr Patrick O'Connor, the manager of Bulmacau Station in Safia who gave us shelter and allowed us to collect in Foasi Creek. We also thank Miss Betty Thorn for her drawing of the holotype and Basim Said and John Patten for their help with osteology and comments on the relationships within the genus *Craterocephalus*. Dr D. Hales and Dr J. Bassett are thanked for reading and commenting on the manuscript.

References

- ALLEN, G. R., 1982. — *A field guide to inland fishes of Western Australia*. Perth: Western Australian Museum, 86pp.
- , and CROSS, N. J., 1982. — *Rainbowfishes of Australia and Papua New Guinea*. London: Sydney: Angus and Robertson Publishers.
- GÜNTHER, A., 1861. — *Catalogue of the acanthopterygian fishes in the British Museum*. Vol. 3. London: British Museum, 586pp.
- , 1867. Additions to the knowledge of Australian reptiles and fishes. *Ann. Mag. Nat. Hist.*, 20: 45-68.
- IVANTSOFF, W., 1978. — Taxonomic and systematic review of the Australian fish species of the family Atherinidae with references to related species of the Old World. North Ryde: Macquarie University, Ph.D. thesis, unpubl.
- , CROWLEY, L. E. L. M., and ALLEN, G. R., 1987. — Description of three new species and one subspecies of freshwater hardyheads (Pisces: Atherinidae: *Craterocephalus*) from Australia. *Rec. West. Aust. Mus.*, 13(2): 171-188.
- , and GLOVER, C. J. M., 1974. — *Craterocephalus dalhousiensis* new species, a sexually dimorphic freshwater teleost (Atherinidae) from South Australia. *Aust. Zool.* 18(2): 88-98.
- MERRICK, J. R., and SCHMIDA, G. E., 1984. — *Australian Freshwater Fishes. Biology and Management*: 143-152. Adelaide: Griffin Press Limited.
- MUNRO, I. S. R., 1967. — *The Fishes of New Guinea*. Port Moresby: Dept. Agr., Stock and Fisheries, 650pp.
- NICHOLS, J. T., and RAVEN, H. C., 1934. — Two new freshwater fishes (Percosoccs) from New Guinea. *Amer. Mus. Novit.* 755: 1-4.
- Ogilby, J. D., 1912. — On some Queensland fishes. *Mem. Qld Mus.* 1: 26-65.
- PATTEN, J. M., 1978. — Osteology, relationships and classification of hardyheads of the subfamily Atherininae (Pisces: Atherinidae). North Ryde: Macquarie University, M.Sc. thesis, unpubl.
- PROC. LINN. SOC. N.S.W., 109 (4), (1986) 1987

The location of this species is of great interest since all other hardyhead species from Papua New Guinea occur in southern drainages. These are *C. randi*, extending from the Fly River to the Port Moresby area, *C. lacustris*, at present known only from Lake Kutubu, but possibly also occurring in the Kiori and Wago Rivers draining the lake to the south, and *C. nouhuysi*, occurring in the Lorenz River, Irian Jaya, near the border of Papua New Guinea and possibly in the upper tributaries of the Fly River near Tabubil. These species are all members of the '*C. stercusmuscarum*' group. Their closely related counterparts, *C. stercusmuscarum stercusmuscarum* and *C. species B* (Allen, 1982) occur on the other side of the Arafura Sea and Torres Strait. *C. marjoriae*, *C. marianae* Ivantsoff *et al.*, 1987 and *C. species A* (Allen, 1982) also occur in the northern coastal areas of Australia but there are no known south coast representatives of the '*eyresii*' group in Papua New Guinea.

It appears that speciation of the genus *Craterocephalus* may have been slow, unlike the Melanotaeniidae, another speciose group of freshwater fishes common to both Papua New Guinea and Australia (Allen and Cross, 1982). *C. kailolae* must have been separated from its north Australian relatives 2-5 million years ago, that is, since the uplifting of the highlands in Papua New Guinea during Plio/Pleistocene (Veevers, 1984). The members of the '*C. stercusmuscarum*' group, on the other hand, could still have been sympatric 7-10,000 years ago, prior to the last transgression on Torres Strait, thus allowing for gene flow to continue and maintain similarity. *C. randi* and *C. s. stercusmuscarum* for example are morphologically and osteologically very close. The fact that *C. kailolae* is readily identifiable as a member of the '*C. eyresii*' group (although morphologically distinct from other members) supports the proposal that members of the genus *Craterocephalus* do not speciate rapidly.

ACKNOWLEDGEMENTS

We thank John Paska of Port Moresby who helped us to collect the fish, and Mr Patrick O'Connor, the manager of Bulmacau Station in Safia who gave us shelter and allowed us to collect in Foasi Creek. We also thank Miss Betty Thorn for her drawing of the holotype and Basim Said and John Patten for their help with osteology and comments on the relationships within the genus *Craterocephalus*. Dr D. Hales and Dr J. Bassett are thanked for reading and commenting on the manuscript.

References

- ALLEN, G. R., 1982. — *A field guide to inland fishes of Western Australia*. Perth: Western Australian Museum, 86pp.
- , and CROSS, N. J., 1982. — *Rainbowfishes of Australia and Papua New Guinea*. London: Sydney: Angus and Robertson Publishers.
- GÜNTHER, A., 1861. — *Catalogue of the acanthopterygian fishes in the British Museum*. Vol. 3. London: British Museum, 586pp.
- , 1867. Additions to the knowledge of Australian reptiles and fishes. *Ann. Mag. Nat. Hist.*, 20: 45-68.
- IVANTSOFF, W., 1978. — Taxonomic and systematic review of the Australian fish species of the family Atherinidae with references to related species of the Old World. North Ryde: Macquarie University, Ph.D. thesis, unpubl.
- , CROWLEY, L. E. L. M., and ALLEN, G. R., 1987. — Description of three new species and one subspecies of freshwater hardyheads (Pisces: Atherinidae: *Craterocephalus*) from Australia. *Rec. West. Aust. Mus.*, 13(2): 171-188.
- , and GLOVER, C. J. M., 1974. — *Craterocephalus dalhousiensis* new species, a sexually dimorphic freshwater teleost (Atherinidae) from South Australia. *Aust. Zool.* 18(2): 88-98.
- MERRICK, J. R., and SCHMIDA, G. E., 1984. — *Australian Freshwater Fishes. Biology and Management*: 143-152. Adelaide: Griffin Press Limited.
- MUNRO, I. S. R., 1967. — *The Fishes of New Guinea*. Port Moresby: Dept. Agr., Stock and Fisheries, 650pp.
- NICHOLS, J. T., and RAVEN, H. C., 1934. — Two new freshwater fishes (Percosoccs) from New Guinea. *Amer. Mus. Novit.* 755: 1-4.
- Ogilby, J. D., 1912. — On some Queensland fishes. *Mem. Qld Mus.* 1: 26-65.
- PATTEN, J. M., 1978. — Osteology, relationships and classification of hardyheads of the subfamily Atherininae (Pisces: Atherinidae). North Ryde: Macquarie University, M.Sc. thesis, unpubl.
- PROC. LINN. SOC. N.S.W., 109 (4), (1986) 1987

- , and IVANTSOFF, I., 1983. — A new genus and species of atherinid fish *Dentatherina merceri* from the western Pacific. *Jap. Jour. Ichthyol.* 29(4): 329-339.
- POTTER, I. C., IVANTSOFF, W., CAMERON, R., and MINNARD, J., 1986. — Life cycles and distribution of atherinids in the marine and estuarine waters of southern Australia. *Hydrobiologia* 139(3): 23-40.
- PRINCE, J. D., IVANTSOFF, W., and POTTER, I. C., 1982. — *Atherinosoma wallacei* a new species of estuarine and inland silverside (Teleostei: Atherinidae) from the Swan-Avon and Murray Rivers, Western Australia. *Aust. Zool.* 21(1): 63-74.
- RENDABL, H., 1922. — A contribution to ichthyology of north-west Australia. *Meddr Zool. Mus. Krist.*, 5: 163-197.
- STEINDACHNER, F., 1884. — Beiträge zur Kenntniss der Fische Australiens. *Sitzungsb. K. Akad. Wiss. Wien* 88(1): 1065-1108.
- TAYLOR, W. R., 1967. — An enzyme method of clearing and staining small vertebrates. *Proc. U.S. Nat. Mus.* 122: 1-17.
- TREWAVAS, E., 1940. — On new Papuan fishes. *Ann. Mag. Nat. Hist.* 6(33): 284-287.
- VEEVERS, J., (ed.), 1984. — *Phanerozoic Earth History of Australia*. Oxford: Clarendon Press.
- WEBER, M., 1910. — Neue Fische aus Niederländisch Sud-Neu-Guinea. *Notes Leyden Mus.* 32(4): 225-240.
- WHITLEY, G. P., 1948. — Ichthyological descriptions and notes. *Proc. Linn. Soc. N.S.W.* 68(3&4): 114-144.
- , 1944. — New sharks and fishes from Western Australia. *Aust. Zool.* 10(3): 252-273.
- , 1948. — Studies in ichthyology, No. 13. *Rec. Austr. Mus.* 22(1): 70-94.
- , 1950. — Studies in ichthyology, No. 14. *Rec. Austr. Mus.* 22(3): 234-245.

- , and IVANTSOFF, I., 1983. — A new genus and species of atherinid fish *Dentatherina merceri* from the western Pacific. *Jap. Jour. Ichthyol.* 29(4): 329-339.
- POTTER, I. C., IVANTSOFF, W., CAMERON, R., and MINNARD, J., 1986. — Life cycles and distribution of atherinids in the marine and estuarine waters of southern Australia. *Hydrobiologia* 139(3): 23-40.
- PRINCE, J. D., IVANTSOFF, W., and POTTER, I. C., 1982. — *Atherinosoma wallacei* a new species of estuarine and inland silverside (Teleostei: Atherinidae) from the Swan-Avon and Murray Rivers, Western Australia. *Aust. Zool.* 21(1): 63-74.
- RENDABL, H., 1922. — A contribution to ichthyology of north-west Australia. *Meddr Zool. Mus. Krist.*, 5: 163-197.
- STEINDACHNER, F., 1884. — Beiträge zur Kenntniss der Fische Australiens. *Sitzungsb. K. Akad. Wiss. Wien* 88(1): 1065-1108.
- TAYLOR, W. R., 1967. — An enzyme method of clearing and staining small vertebrates. *Proc. U.S. Nat. Mus.* 122: 1-17.
- TREWAVAS, E., 1940. — On new Papuan fishes. *Ann. Mag. Nat. Hist.* 6(33): 284-287.
- VEEVERS, J., (ed.), 1984. — *Phanerozoic Earth History of Australia*. Oxford: Clarendon Press.
- WEBER, M., 1910. — Neue Fische aus Niederländisch Sud-Neu-Guinea. *Notes Leyden Mus.* 32(4): 225-240.
- WHITLEY, G. P., 1948. — Ichthyological descriptions and notes. *Proc. Linn. Soc. N.S.W.* 68(3&4): 114-144.
- , 1944. — New sharks and fishes from Western Australia. *Aust. Zool.* 10(3): 252-273.
- , 1948. — Studies in ichthyology, No. 13. *Rec. Austr. Mus.* 22(1): 70-94.
- , 1950. — Studies in ichthyology, No. 14. *Rec. Austr. Mus.* 22(3): 234-245.